Electric and Magnetic Fields

Electric and magnetic fields are generated by all power sources, including conductors, wiring, tools, and appliances. The fields increase with the magnitude of the power source, but dramatically decrease with distance from the source conductor or wiring.

Electric fields and magnetic fields are independent of each other.

- Electric fields result from the energization of the wiring.
- Magnetic fields result from the flow of power (current) as it serves the load being applied.

Electric fields are reduced by distance, by mutual cancellation (placing the wires as close together as possible without creating an arc between them) or by placing objects or insulation between the wire and the exposure location. Magnetic fields are reduced by distance, by mutual cancellation, or by specific types of shields. However, they are not reduced by most objects between them and the source wires.

Health effects

The incidence of cancer has not increased with the increased use of electricity in the United States or any other country that measures incidence rates. Scientists and doctors have found no testable hypothesis that demonstrates a possible mechanism by which power fields can cause adverse health effects, cancer, or any other disease or debilitating condition.

The effects of fields from power lines have been the object of research since the late 1950s. Over 26,000 research reports have been generated in that time, and none report adverse health cause and effect. High exposures in controlled laboratory tests have not created any adverse cause-and-effect relationship.

A 1979 study in Denver, Colorado, reported on preliminary research of possible environmental factors associated with childhood cancer. Since then, at least a dozen similar studies have been completed in an effort to determine the relationship. More than half of the studies reported no association. Those that did report a possible association have not been reproducible in later studies that were larger and better controlled.

Using the raw data on fields and exposures collected in the dozen studies, the International Agency for Research on Cancer concluded that there may be a possible association between a single, rare form of childhood cancer and magnetic fields. If the possibility does exist, it is a very low probability and a mechanism for causation is not known.

Examples of Common Sources of Magnetic Fields

Source	Median	Highest
Hair dryers	300 mG* at 6 inches 1 at 1 foot	700 mG at 6 inches 70 at 1 foot
Electric razors	100 mG at 6 inches 20 at 1 foot	600 mG at 6 inches 100 at 1 foot
Blenders	70 mG at 6 inches 10 at 1 foot	100 mG at 6 inches 20 at 1 foot
Can openers	600 mG at 6 inches 150 at 1 foot	1500 mG at 6 inches 300 at 1 foot
Coffee makers	7 mG at 6 inches immeasurable at 1 foot	10 mG at 6 inches 1 at 1 foot
Dishwashers	20 mG at 6 inches 10 at 1 foot	100 mG at 6 inches 30 at 1 foot *milligauss
Microwave ovens	80 mG at 6 inches 10 at 1 foot	100 mG at 6 inches 20 at 1 foot
Mixers	100 mG at 6 inches 10 at 1 foot	600 mG at 6 inches 100 at 1 foot
Electric ranges	30 mG at 6 inches, 8 at 1 foot	200 mG at 6 inches, 30 at 1 foot
Refrigerators	2 mG at 6 inches 2 at 1 foot	40 mG at 6 inches 20 at 1 foot
Vacuum cleaners	300 mG at 6 inches 60 at 1 foot	700 mG at 6 inches 200 at 1 foot
Analog clocks	15 mG at 1 foot	30 mG at 1 foot
Baby monitors	6 mG at 6 inches 1 at 1 foot	15 mG at 6 inches 2 at 1 foot
Battery chargers	30 mG at 6 inches 3 at 1 foot	50 mG at 6 inches 4 at 1 foot
Hand drills	150 mG at 6 inches 30 at 1 foot	200 mG at 6 inches 40 at 1 foot
Power saws	200 mG at 6 inches 40 at 1 foot	1,000 mG at 6 inches 300 at 1 foot

Copy machines	90 mG at 6 inches 20 at 1 foot	200 mG at 6 inches 40 at 1 foot
Fax machines	6 mG at 6 inches	9 mG at 6 inches 2 at 1 foot
Fluorescent lights	40 mG at 6 inches 6 at 1 foot	100 mG at 6 inches 30 at 1 foot
Pencil sharpeners	200 mG at 6 inches 70 at 1 foot	300 mG at 6 inches 90 at 1 foot
Computers with color monitors	14 mG at 6 inches 5 at 1 foot	20 mG at 6 inches 6 at 1 foot

Additional sources of information

Reviews of EMF research:

• American Medical Association, Council on Scientific Affairs. Effects of Electric and Magnetic Fields. Chicago: American Medical Association (December 1994).

• National Institute for Occupational Safety and Health, National Institute of Environmental Health Sciences, U.S. Department of Energy. Questions and Answers: EMF in the Workplace, Electric and Magnetic Fields Associated with the Use of Electric Power. Report No. DOE/GO-10095-218 (September 1996).

• National Radiological Protection Board. ELF Electromagnetic Fields and the Risk of Cancer. Volume 12:1, Chilton, Didcot, Oxon, UK, OX11 ORQ (2001).

• National Research Council, Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems. Possible Health Effects of Exposure to Residential Electric and Magnetic Fields. Washington: National Academy Press (1997).

• National Institute of Environmental Health Sciences. Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields, NIH Publication No. 99-4493. Research Triangle Park, National Institute of Environmental Health Sciences (1999).

• Portier, C.J. and M.S.Wolfe, Eds. Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields, NIEHS Working Group Report, NIH Publication No. 98-3981. Research Triangle Park, National Institute of Environmental Health Sciences (1998).

Online sources of information:

• EMF Electric and Magnetic Fields Associated with the Use of Electric Power, Q&A Prepared by the National Institute of Environmental Health Sciences and the National Institutes of Health, June 2002. (PDF version.)

• Documents from the National Radiological Protection Board